THE MATERIALS TESTING CENTER (MTC)

SCHEDULE OF CHARGES FOR TESTING AND SERVICES AND QUANTITIES OF MATERIAL REQUIRED FOR TESTING

July 2008

TABLE OF CONTENTS

SCHEDULE OF CHARGES FOR TESTING AND SERVICES
AND QUANTITIES OF MATERIAL REQUIRED FOR TESTING

PREFACE

The Materials Testing Center (MTC), US Army Engineer Research and Development Center (ERDC), Vicksburg, MS, provides material testing and laboratory inspection services for US Army Corps of Engineers (USACE) Divisions, Districts, other field offices and contract laboratories.

The mailing address for these services is:

Commander and Director
Engineering and Research Development Center
ATTN: CEERD-GS-E
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Technical services such as testing and evaluation of materials are provided to support design and construction of Military and Civil Works projects, procurement services for USACE activities, and technical requirements of other government agencies. Technical supervision for testing performed at project laboratories is also available as directed in Engineer Regulation (ER) 1110-1-8100.

Estimated charges for routine testing services listed in this schedule include direct costs of labor and materials, normal indirect charges, and costs of final reporting and preparation of reports and drawings as required. The minimum charge for a testing project is $500. Charges for tests of a specialized nature or for services that are not routine are shown as “Cost” in the schedule. For some, a minimum cost or a range of costs is given. For test assignments having estimated costs of $3,000 or less, add ten (10) percent to cover additional pro rata costs of sample receiving, sample handling, and data reporting. Estimates of these charges for specific projects or investigations will be furnished upon request. Charges are based on total direct and indirect costs in accordance with ER 1110-1-8100.

All samples or specimens submitted for testing must be identified and labeled clearly so that they require only normal processing.

Requests for tests should be submitted to the MTC on DD Form 448 or DA Form 2544. The original and three copies should be furnished. Acceptance copies of the completed forms will be signed and returned to the requesting agency. Completed forms should include: (a) specific tests requested, (b) project name and location, (c) contract or specification number, (d) type and source of materials, (e) other pertinent identifying information.

All USACE offices are invited to call for assistance in solving their design and construction problems in the fields of geology, petrography, soils, rock, concrete and concrete materials, water analysis, asphalt, paving materials, and acceptance testing of most engineering materials. Capabilities available in the MTC vary from routine (conventional) testing to specialized investigations.

References for test methods shown are:

1) American Society for Testing and Materials (ASTM) Annual Book of Standards (Section 4-Construction, Volumes 04.01-04.05, and 04.07-04.09).

2) Engineer Manual (EM) 1110-2-1906, Engineering and Design, Laboratory Soils Testing

3) Engineer Manual (EM) 1110-2-2000, Engineering and Design, Standard Practice for Concrete for Civil Works Structures

4) Engineer Manual (EM) 1110-2-2002, Engineering and Design, Evaluation and Repair of Concrete Structures

5) Engineer Manual (EM) 1110-2-2006, Engineering and Design, Roller Compacted Concrete

6) Engineer Regulation (ER) 1110-1-2002, Engineering and Design, Cement, Slag, and Pozzolan Acceptance Testing

7) Technical Memorandum (TM) No. 3-357, The Unified Soil Classification System

8) Technical Report (TR) No. GL-86-13, The Large Strain, Controlled Rate of Strain (LSCRS) Device for Consolidation Testing of Soft Fine-Grained Soils

9) U.S. Army Corps of Engineers Handbook of Concrete and Cement (CRD-C), available at http://www.wes.army.mil/SL/MTC/handbook/handbook.htm

10) U.S. Army Corps of Engineers Rock Testing Handbook (RTH), available at http://www.wes.army.mil/SL/MTC/handbook/RT/RockTestingHandbook.htm

The MTC assists Divisions and Districts by performing laboratory inspections for Quality Assurance (QA) and Quality Control (QC) laboratories. The typical cost for a full on-site laboratory inspection varies from approximately $5,500 to $10,500 depending on travel requirements and the scope of the inspection services. In addition, there are two types of audits, full and abbreviated, that can be performed if the laboratory has been inspected/accredited by AMRL and/or CCRL. A full audit can be performed for a cost of $3,500 if the laboratory has been inspected by AMRL and/or CCRL but is not accredited by AASHTO. An abbreviated audit can be performed for $2,000 if the laboratory has a current accreditation from AASHTO.

The Handbook for Concrete and Cement, ASTM Annual Book of Standards, and other publications recommend other tests not specifically listed here. The MTC is staffed and equipped to perform many of these additional tests. Check with us rather than neglect testing that should and could be done.

This schedule gives (a) tests costs and (b) quantities of material required for testing.

PART A

TESTS OF SOILS

TESTS OF SOILS

Costs of Individual Tests and Analyses (July 2008)

Test	Description	Cost, $
--	Sample receiving and disposal fee (per undisturbed or bag sample)	55
ASTM D 2488 TM 3-357	Visual classification and water content (jar or bag)	45
ASTM D 2488 TM 3-357	Visual classification, description of stratification, pocket penetrometer readings, and sketch (record sample)	219
ASTM D 2974	Organic content (loss on ignition)	66
ASTM D 422 EM 1110-2-1906 Appendix V ASTM D 1140	Sieve analysis (includes soil classification): Percent fines (wash over #200) Sand (#4 to #200; sample is routinely washed) Gravel (plus #4; sample is routinely washed) Clay gravel (requiring washing) Sand fraction, as part of combined analysis	 39 83 110 264 66
ASTM D 422 EM 1110-2-1906 Appendix V	Hydrometer analysis (includes soil classification) oven-dried before test wet method	 77 94
ASTM D 4318 EM 1110-2-1906 Appendix III	Liquid and plastic limits (Atterberg, includes soil classification) 1-point method (washed through #40 sieve) 4-point method (washed through #40 sieve) If clay gravel requiring extensive washing	 132 193 303
ASTM D 4644	Slake durability (clay shales)	303
ASTM D 854 EM 1110-2-1906 Appendix IV	Specific gravity: Absolute (clay or sand) Apparent or bulk (gravel)	 77 99
ASTM D 4647 EM 1110-2-1906 Appendix XIII	Pinhole erosion (to identify dispersive clays): Undisturbed sample Compacted sample	 385 440
ASTM D 698 ASTM D 1557 ASTM D 1883 ASTM D 4253 ASTM D 4254	Density Determinations: Compaction (moisture-density, 5-point curve): 4-in.-diam mold 6-in.-diam mold with California Bearing Ratio (CBR), 6-in.-diam mold	 715 798 1,100
EM 1110-2-1906 Appendix VI EM 1110-2-1906 Appendix XII	Maximum/minimum (using vibratory table): Sands Gravels	 385 418

Costs (cont.)

Test	Description	Cost, $
ASTM D 2216 EM 1110-2-1906 Appendix I	Water content (per jar or bag)	28
ASTM D 2937 EM 1110-2-1906 Appendix II	Density and water content plus visual classification:	
	Undisturbed sample, direct measurement	154
	Undisturbed sample, displacement method	193
	Density and water content only	88
ASTM D 2937 EM 1110-2-1906 Appendix II	Incremental density on sand, (3-in.-diam Shelby tube per increment)	66
ASTM D 5084 EM 1110-2-1906 Appendix VII	Hydraulic Conductivity (Permeability):	
	In triaxial compression chamber using back-pressure saturation	880
ASTM D 2435 EM 1110-2-1906 Appendix VIII	Consolidation to 16 tons/sq ft (7 loads) plus rebound (3); add $ 25 for each additional load (maximum of 64 tons/sq ft on 4.25-in.-diam specimen and 185 tons/sq ft on 2.5-in.-diam specimen):	
	Undisturbed specimen	770
	Compacted specimen	880
TR # GL-86-13	Consolidation (self weight for dredge materials)	1,650
ASTM D 4546 EM 1110-2-1906 Appendix VIIIA	Swell pressure	440
ASTM D 4546 EM 1110-2-1906 Appendix VIIIA	Free swell	440
ASTM D 3080 EM 1110-2-1906 Appendix IX	Direct shear, S (consolidated, drained, controlled strain, 3-in.-sq specimen, max σ_n = 8 tons/sq ft, 3 specimens, 0.5 in. displacement in 48 hours):	
	Undisturbed	880
	Compacted	1,018
EM 1110-2-1906 Appendix IXA	Repeated S direct shear (consolidated, drained, 3-in.-sq specimen, max σ_n = 8 tons/sq ft, precut shear plane)	963
ASTM D 2166 EM 1110-2-1906 Appendix XI	Unconfined triaxial compression:	
	1.4-in.-diam (undisturbed specimens)	165
	1.4-in.-diam (remolded specimens)	209
	larger than 1.4-in.-diam (undisturbed specimens)	352
	larger than 1.4-in. diam (remolded specimens)	495
	larger than 1.4-in.-diam (Hydrostone capped)	385

Costs (cont.)

Test	Description	Cost, $
ASTM D 2850 EM 1110-2-1906 Appendix X	Triaxial compression (shear): Q (undisturbed, unconsolidated, undrained): 3 specimens, 1.4-in.-diam 1 specimen, larger than 1.4-in.-diam	 715 440
ASTM D 2850 EM 1110-2-1906 Appendix X	Q (compacted, unconsolidated, undrained): 3 specimens, 1.4-in.-diam	 825
ASTM D 4767 EM 1110-2-1906 Appendix X	R-bar (undisturbed, consolidated, undrained, saturation by back pressure, pore pressures measured during shear): 3 specimens, 1.4-in.-diam	 1,100
ASTM D 4767 EM 1110-2-1906 Appendix X	R-bar (compacted, consolidated, undrained, saturation by back pressure, pore pressures measured during shear): 3 specimens, 1.4-in.-diam	 1,265
ASTM D 4648	Vane shear (strength, visual classification, water content)	88

Large Scale Tests

Triaxial tests (monotonic and cyclic, including dynamic properties, falling head permeability, isotropic or Kc consolidation, etc.) 2.8, 4.0, 5.0, 6.0, 9.0, 12.0, and 15.0” dia	Cost*
1-D consolidation (12" dia)	Cost*
Permeability (constant head) 11, 18, 36" dia vertical 4' x 4' x 6' horizontal	Cost*
Compaction 6", 12", 18" dia	Cost*
Direct/Interface Shear 2' x 2' x 1'	Cost*
Resonant Column 1.4", 2.8", 4.0" dia	Cost*
Stress Chamber (Soil Structure Interaction Studies) 5' dia x 6' high	Cost*

* Estimated costs per specimen => $200 to $10,000 or more (depending on specific test requirements and material)

Material requirements => 100 lb to several tons (depending on specific test requirements and material)

Time requirements per specimens => several days to several weeks (depending on specific test requirements and material)

Quantities of Materials Required for Testing

Test	Description	Quantity Required
	Soils	
ASTM D 2216	Water content (per jar or bag)	
	maximum particle size, #4 sieve	0.1 kg (0.2 lb)
	maximum particle size, 3/8-in. sieve	0.5 kg (1.1 lb)
	maximum particle size, 3/4-in. sieve	2.5 kg (5.5 lb)
ASTM D 2488	Visual classification	
	maximum particle size, #4 sieve	0.1 kg (0.2 lb)
	maximum particle size, 3/8-in. sieve	0.2 kg (0.4 lb)
	maximum particle size, 3/4-in. sieve	1.0 kg (2.2 lb)
ASTM D 422	Sieve / Hydrometer analysis	
	maximum particle size, #4 sieve	0.1kg (0.2 lb)
	maximum particle size, 3/8-in. sieve	0.6 kg (1.3 lb)
	maximum particle size, 3/4-in. sieve	1.1 kg (2.4 lb)
ASTM D 4318	Liquid and plastic limits (Atterberg)	0.2 kg (0.4 lb)
ASTM D 854	Specific gravity	
	maximum particle size, #10 sieve	0.02 kg (0.04 lb)
	maximum particle size, #4 sieve	0.1 kg (0.2 lb)
ASTM D 698	Compaction (4 in. mold)	22.7 kg (50.0 lb)
ASTM D 1557	Compaction (6 in. mold)	45.4 kg (100.0 lb)
ASTM D 4253	Maximum/minimum density	
ASTM D 4254	maximum particle size, 3/4-in. sieve	11.0 kg (24.3 lb)
	maximum particle size, 1-1/2-in. sieve	34.0 kg (75.0 lb)
ASTM D 2850	Triaxial compression (Q, R-bar)	
	1.4 in.-dia (3 specimens)	1.0 kg (2.2 lb)
	2.8 in.-dia (3 specimens)	4.0 kg (8.8 lb)
ASTM D 5084	Hydraulic conductivity (permeability)	
	1.4 in.-dia	0.4 kg (0.9 lb)
	2.8 in.-dia	1.6 kg (3.6 lb)
ASTM D 2435	Consolidation	
	Fixed ring (4.4-in. dia)	0.6 kg (1.3 lb)
	Self weight (dredge materials)	7.0 kg (15.4 lb)
ASTM D 3080	Direct shear (3 specimens, 3-in. sq.)	1.0 kg (2.2 lb)

PART B

TESTS OF AGGREGATE, RIPRAP STONE, AND ROCK

TESTS OF AGGREGATE, RIPRAP STONE, AND ROCK

Costs of Individual Tests and Analyses

Test	Description	Cost, $
	Aggregates	
ASTM C 29	Unit Weight of Aggregate	
	a. Fine aggregate	110
	b. Coarse aggregate	215
ASTM C 40	Organic Impurities in Fine Aggregate	110
ASTM C 87	Effect of Organic Impurities in Fine Aggregate on Strength of Mortar	1,645
ASTM C 88	Soundness of Aggregate in Magnesium or Sodium Sulfate (Fine or Coarse)	539
ASTM C 117	Material Finer than 75-μm (No. 200) Sieve	
	a. Fine aggregate	110
	b. Coarse aggregate: 37.5-mm (1-1/2-in.)	215
	c. Coarse aggregate: 75-mm (3-in.) and larger	429
ASTM C 123	Percent of Lightweight Pieces in Aggregate	
	a. Fine aggregate	429
	b. Coarse aggregate	539
ASTM C 127	Specific Gravity and Absorption of Coarse Aggregate	325
ASTM C 128	Specific Gravity and Absorption of Fine Aggregate	429
ASTM C 131	Los Angeles Abrasion Resistance of Small-Size Coarse Aggregate	539
ASTM C 136	Sieve Analysis	
	a. Fine aggregate	215
	b. Coarse aggregate: 37.5-mm (1-1/2-in.)	325
	c. Coarse aggregate: 75-mm (3-in.)	858
ASTM C 142	Clay Lumps and Friable Particles in Aggregate	325
ASTM C 227	Alkali-Reactivity (Mortar Bar Method)	1,716
ASTM C 289	Alkali-Silica Reactivity (Chemical Method)	1,716
ASTM C 295	Petrographic Examination	
	a. Fine aggregate, per sample	1,716
	b. Coarse aggregate, per sample	3,432
	c. Ledge rock as aggregate, per rock type	858

Costs (cont.)

Test	Description	Cost, $
	Aggregates (Contd.)	
ASTM C 342	Volume Changes in Cement-Aggregate Combination	1,716
ASTM C 535	Los Angeles Abrasion Resistance of Large-Size Coarse Aggregate	644
ASTM C 586	Alkali-Carbonate Reactivity (Rock Cylinder Method)	539
ASTM C 1105	Alkali-Carbonate Reactivity (Concrete Prism Method)	2,150
ASTM C 1260	Alkali-Silica Reactivity (Mortar-Bar Method)	
	a. Fine Aggregate	1,716
	b. Coarse Aggregate	2,150
ASTM C 1293	Alkali-Silica Reactivity (Concrete Prism Method)	2,150
ASTM C 1567	Alkali-Silica Reactivity (Mortar-Bar Method)	
	a. Fine Aggregate	1,716
	b. Coarse Aggregate	2,150
ASTM D 75	Field Sampling of Aggregates	Cost
ASTM D 4791	Flat and Elongated Particles (Coarse aggregate)	539
CRD-C 114	Freezing and Thawing of Aggregate in Concrete	7,937
	a. Casting	3,432
	b. Testing	4,505
CRD-C 120	Flat and Elongated Particles (Fine aggregate)	754
CRD-C 125	Coefficient of Linear Thermal Expansion	
CRD-C 126	a. Coarse aggregate	5,148
	b. Fine aggregate in mortar	2,255
CRD C 130	Soft Particles in Coarse Aggregate (Scratch Hardness)	429
--	Sample Preparation (crushing, screening, drying)	Cost
	Fractured Faces (five sieve fractions)	325

Costs (cont.)

Test	Description	Cost, $
	Riprap Stone	
ASTM C 88	Sulfate Soundness	644
ASTM C 127	Specific Gravity and Absorption	429
ASTM C 295	Petrographic Examination, per sample	858
ASTM C 535	Los Angeles Abrasion Resistance Test	644
ASTM D 5312	Resistance of Stone to Freezing and Thawing (up to 55 cycles)	2,684
ASTM D 5313	Resistance of Stone to Wetting and Drying (up to 80 cycles)	3,218
CRD-C 144	Resistance of Stone to Freezing and Thawing (20 cycles)	2,150
CRD-C 148	Expansive Breakdown on Soaking in Ethylene Glycol	638
CRD-C 169	Resistance to Wetting and Drying (30 cycles)	2,150

Costs (cont.)

Test	Description	Cost, $
	Rock	
ASTM C 295 RTH 102	Petrographic Examination Rock Type and Physical Condition, per type Rock Mechanics Investigations, per sample X-Ray Thin Section	 1,073 1,073 Cost Cost
ASTM D 2845	Pulse Velocity and Ultrasonic Elastic Constants	325
CRD-C 90	Direct Shear, Intact Rock up to 6-in. dia (three tests)	2,150
EM 1110-2-1906 App IX	Direct Shear, Intact Shale or Friable Rock, 3-in. x 3 in. (three tests)	2,150
EM 1110-2-1906 App IX	Direct Shear, Sawed and Jointed Surfaces for Sliding Friction 3-in. x 3-in. or up to 6-in. dia (three tests) See Note R2	2,150
EM 1110-2-1906 App IX	Direct Shear, Concrete-to-Rock Interface 3-in. x 3-in. or up to 6-in. dia (three tests) See Notes R2, R3	2,150
RTH 106	Water Content	325
RTH 107	Specific Gravity, Absorption, and Moisture Content	429
RTH 108	Specific Gravity of Solids (Grain Density)	539
RTH 109	Effective and Dry Unit Weights and Total Porosity	429
RTH 203	Direct Shear, Intact or Jointed Specimens up to 6-in. dia (three tests to determine angle of internal friction and cohesion)	2,150
—	Porosity and Solids by High Pressure	644
—	Logging Core, initial foot Each additional foot	215 57
—	Sample Receiving and Disposal, per box or block	56
—	Specimen Photographs for Tests where not SOP	16

Costs (cont.)

Test	Description	Cost, $
	Rock (Cont'd)	
ASTM D 4543, RTH 103	Rock coring for test preparation, per cored test specimen	56
--	Adsorption, per test sample	157
ASTM D 2938, RTH 111-89	Unconfined (Uniaxial Static) Compressive Strength, per test, See Notes R1, R2	322
ASTM D 4138, RTH 201-89	Modulus of Elasticity (Static) in Uniaxial Compression, per test, See Notes R1, R2	535 w/o strength, 699 w/strength
ASTM D 4138, RTH 201-89	Modulus of Elasticity (Static) in Uniaxial Compression with Poisson's ratio, per test, See Notes R1, R2	642 w/o strength, 803 w/strength
ASTM D 5731, RTH 325-89	Point Load Index, per test sample, both parallel and crossbed tests as possible	79
ASTM D 2936, RTH 112-93	Tensile Strength, Direct Method, per test, See Note R1	965
ASTM D 3967, C 496, RTH 113-93	Tensile Strength, Splitting (Brazilian) Method, per test, See Notes R1, R2	171
--	Preparation and Compressive Strength Testing of cementitious concrete or grout for bond testing, per mix specification	394
ASTM D 4435, RTH 323-80	Rock Bolt Anchor Pull Test, per test, special anchorages (not cementitious grout) used as provided or at cost, See Notes R2, R3	550
ASTM D 4644	Slake Durability, per test sample, See Note R2	265
--	Miscellaneous In Situ Geohydrology and Rock Mechanics Tests	cost

Quantities of Materials Required for Testing

Test	Description	Quantity Required
	Aggregates	
ASTM C 29	Unit Weight	
	a. 12.5 mm (½ in.)	15 kg (35 lb)
	b. 25.0 mm (1 in.)	50 kg (110 lb)
	c. 37.5 mm (1-1/2 in.)	75 kg (165 lb)
	d. 75 mm (3 in.)	175 kg (385 lb)
	e. 150 mm (6 in.)	250 kg (550 lb)
ASTM C 33	Multiple Tests for Material Compliance	
	a. Fine aggregate	20-kg (44-lb)
	b. Coarse 19.0-mm (3/4-in.) Nominal Maximum Size of Aggregate (NMSA)	35-kg (77-lb)
	c. Coarse 37.5-mm (1-1/2-in.) NMSA	85-kg (188-lb)
	d. Coarse 75-mm (3-in.) NMSA	175-kg (388-lb)
	e. Coarse 150-mm (6-in.) NMSA	300-kg (660-lb)
ASTM C 40	Organic Impurities in Fine Aggregate	10 kg (25 lb)
ASTM C 87	Effect of Organic Impurities in Fine Aggregate on the Strength of Mortar	10 kg (25 lb)
ASTM C 88	Sulfate Soundness	
	a. Fine aggregate	10 kg (25 lb)
	b. Coarse aggregate, 19.0 mm (3/4 in.) NMSA	25 kg (55 lb)
	c. Coarse aggregate, 37.5 mm (1-1/2 in.) NMSA	75 kg (165 lb)
	d. Coarse aggregate, 63 mm (2-1/2 in.) NMSA	125 kg (275 lb)
	e. Coarse aggregate, 90 mm (3-1/2 in.) NMSA	175 kg (385 lb)
ASTM C 117	Material Finer Than 75-μm (No. 200) Sieve	
	a. 2.36 mm (No. 8)	10 kg (25 lb)
	b. 4.75 mm (No. 4)	10 kg (25 lb)
	c. 9.5 mm (3/8 in.)	10 kg (25 lb)
	d. 19.0 mm (3/4 in.)	25 kg (55 lb)
	e. 37.5 mm (1-1/2 in.)	75 kg (165 lb)
ASTM C 123	Lightweight Pieces	
	a. Fine aggregate	10 kg (25 lb)
	b. Coarse aggregate, 9.5 mm (3/8 in.) NMSA	10 kg (25 lb)
	c. Coarse aggregate, 19.0 mm (3/4 in.) NMSA	25 kg (55 lb)
	d. Coarse aggregate, 37.5 mm (1-1/2 in.) NMSA	75 kg (165 lb)
	e. Coarse aggregate, 75 mm (3-in.) NMSA	150 kg (330 lb)
ASTM C 127	Specific Gravity and Absorption of Coarse Aggregate	150 kg (330 lb)
	a. Coarse aggregate, 75 mm (3-in.) NMSA	250 kg (550 lb)
	b. Coarse aggregate, 150 mm (6-in.) NMSA	
ASTM C 128	Specific Gravity and Absorption of Fine Aggregate	10 kg (25 lb)
ASTM C 131	Los Angeles Abrasion Resistance of Small-Size Coarse Aggregate	75 kg (165 lb)

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Aggregates (Contd.)	
ASTM C 136	Sieve Analysis	
	a. Fine	10 kg (25 lb)
	b. Coarse 19.0 mm (3/4 in.) NMSA	25 kg (55 lb)
	c. Coarse 37.5 mm (1-1/2 in.) NMSA	75 kg (165 lb)
	d. Coarse 75 mm (3 in.) NMSA	150 kg (330 lb)
	e. Coarse 150 mm (6 in.) NMSA	250 kg (550 lb)
ASTM C 142	Clay Lumps and Friable Particles	
	a. 19.0 mm (3/4 in.)	25 kg (55 lb)
	b. 37.5 mm (1-1/2 in.)	75 kg (165 lb)
	c. 150 mm (6 in.)	125 kg (275 lb)
ASTM C 227	Alkali-Silica (Mortar Bar)	
	a. Fine aggregate	10 kg (25 lb)
	b. Project cement	10 kg (25 lb)
ASTM C 289	Alkali-Silica (Chemical)	10 kg (25 lb)
ASTM C 295	Petrographic Examination	
	a. Undeveloped quarry	25 kg (55 lb)
	b. Operating quarry	25 kg (55 lb)
	c. Exposed face	25 kg (55 lb)
	d. Undeveloped aggregate site	
	(1) Fine aggregate	10 kg (25 lb)
	(2) 19.0 mm (3/4 in.) NMSA	25 kg (55 lb)
	(3) 37.5 mm (1-1/2 in.) NMSA	75 kg (165 lb)
	(4) 75 mm (3 in.) NMSA	150 kg (330 lb)
	(5) 150 mm (6 in.) NMSA	500 kg (1100 lb)
ASTM C 342	Volume Change in Cement-Aggregate Combination	10 kg (22 lb)
ASTM C 535	Los Angeles Abrasion Resistance of Large-Size Coarse Aggregate	150 kg (330 lb)
ASTM C 586	Alkali-Carbonate Reactivity (Rock Cylinder Method)	
	Minimum 75 mm (3 in.) aggregate	150 kg (330 lb)
ASTM C 851	Soft Particles in Coarse Aggregate (Scratch Hardness)	15 kg (35 lb)
	a. 12.5 mm (2 in.) NMSA	25 kg (55 lb)
	b. 19.0 mm (3/4 in.) NMSA	50 kg (110 lb)
	c. 25.0 mm (1 in.) NMSA	75 kg (165 lb)
	d. 37.5 mm (1-1/2 in.) NMSA	100 kg (220 lb)
	e. 50 mm (2 in.) NMSA	

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Aggregates (Contd.)	
ASTM C 1260	Alkali-Silica Reactivity (Mortar-Bar Method)	
	Fine aggregate	10 kg (22 lb)
	Coarse aggregate	50 kg (110 lb)
ASTM C 1293	Alkali-Silica Reactivity (Concrete Prism Method)	
	Fine aggregate	20 kg (44 lb)
	Coarse aggregate	100 kg (220 lb)
	Flat and Elongated Particles	
ASTM D 4791	a. Coarse aggregate	75 kg (165 lb)
CRD-C 120	b. Fine aggregate	10 kg (22 lb)
CRD-C 114	Freezing and Thawing of Aggregate in Concrete	See CRD-C 100
	a. Fine aggregate	500 kg (1,100 lb)
	b. Coarse 19.0-mm (3/4 in.) NMSA	1000 kg (2,200 lb)
	c. Coarse 37.5-mm (1-1/2 in.) NMSA	1000 kg (2,200 lb)
	d. Coarse 75-mm (3 in.) NMSA	1000 kg (2,200 lb)
	e. Coarse 150-mm (6 in.) NMSA	1000 kg (2,200 lb)
	Coefficient of Linear Thermal Expansion	
CRD-C 125	a. Fine aggregate	10 kg (25 lb)
CRD-C 126	b. Coarse aggregate, 75 mm (3 in.) NMSA	3 samples
	c. Ledge rock or rock core	3 samples
--	Fracture Faces (five sieve fractions)	20 kg (30 lb)

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Riprap	
ASTM C 88	Sulfate Soundness, per rock type	50 kg (100 lb)
ASTM C 127	Specific Gravity & Absorption	70 kg (150 lb)
ASTM C 295	Petrographic Examination, per stratum	10 kg (25 lb)
ASTM D 5312	Resistance to Freezing and Thawing, per rock type, cubical shape, three each	3 stones
ASTM D 5313	Resistance to Freezing and Thawing, per rock type, cubical shape, three each	3 stones
CRD-C 144	Resistance to Freezing and Thawing, per rock type, 70 kg (150 lb), cubical shape, three each	3 stones
CRD-C 148	Expansive Breakdown on Soaking in Ethylene Glycol	50 kg (110 lb)
CRD-C 169	Resistance to Wetting & Drying, per rock type 70 kg (150 lb), cubical shape, three each	3 stones

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Rock	
RTH 107	Specific Gravity, Absorption, and Moisture Content, cylindrical specimens	5 kg (11 lb)
RTH 108	Specific Gravity of Solids (Grain Density)	5 kg (11 lb)
--	Porosity and Solids by High Pressure, drilled cores	3 Pieces
ASTM C 127, RTH 106-93, 107-93, 108-93, 109-93	Water Content, Unit Weight, Absorption, and Specific Gravity - Core or block for obtaining fragments	Fragment dimensions 2-in. minimum, 3-in. maximum; three fragments per test sample
--	Adsorption Core or block for obtaining fragments	Five fragments at least 100 g each per test sample
ASTM C 295, RTH 102-93	Petrographic Examination -- Block, Core or Hand Sample, X-Ray, Thin Section	as available
	Core or block fragments – undeveloped quarry developed quarry	25 kg (55 lb) 25 kg (55 lb)
ASTM D 2938, RTH 111-89	Unconfined (Uniaxial Static) Compressive Strength Good Quality core (See Note R4) preferred, or blocks for coring	Core fragments with length at least 2.5X diameter; one per test
ASTM D 4138, RTH 201-89	Modulus of Elasticity (Static) in Uniaxial Compression Good quality core preferred (See Note R4), or blocks for coring	Core fragments with length at least 2.5X diameter; one per test if strength if strength is required
ASTM 4138, RTH 201-89	Modulus of Elasticity (Static) in Uniaxial Compression with Poisson's ratio Good quality core preferred (See Note R4), or blocks for coring	Core fragments with length at least 2.5X diameter; one per test if strength is required
ASTM D 5731, RTH 325-89	Point Load Index Core or block for making fragments	Min fragment dimension 30 mm (1.2-in.), max dimension 85 mm (3.3-in.); one per test
ASTM D 2936, RTH 112-93	Tensile Strength, Direct Method Good quality core preferred (See Note R4), or blocks for coring	Core fragments min. length 2.5X diameter; min 1 7/8-in. dia (47 mm), max 4-in. dia (100 mm); one per test

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Rock (Cont'd)	
ASTM D 3967, RTH 113-93	Tensile Strength, Splitting (Brazilian) Method Core preferred, or blocks for coring	Core fragments min. length 1.5X dia; min 1-in. dia (25 mm), max 5-in. dia (125 mm); one per test
CRD C 90, RTH 203-80, EM 1110-2-1906	Direct Shear of Rock -- Intact Suite of 3 tests Intact core or block fragments This includes so-called shale layers or partings that are not to be separated before shear	Min thickness (normal to shear) 1/3X width; Min 2-in. width (50 mm), max 6-in. width (150 mm); 3 per suite
RTH 203-80	Direct Shear of Rock -- Jointed or Sawed Surfaces Suite of 3 tests Core or block fragments including separated joint with faces mated OR shale parting to be split apart before shearing OR sawed surface location specified	Min thickness 1/3X width; Min 2-in. width (50 mm), max 6-in. width (150 mm); 3 per suite
--	Direct Shear of Rock -- Concrete on Rock Suite of 3 tests Core or block fragments Concrete or grout mix design	Min thickness 1/4X width; Min 2-in. width, max 6-in. width; 3 per suite
ASTM D 4435, RTH 323-80	Rock Bolt Anchor Pull Test Core preferred, or blocks for coring Anchor bolt specification Grout mix design	Min 4-in. (100 mm) dia, max 6-in. (150 mm) dia; Min 5-in. length (125 mm); 1 per test
ASTM D 2664, RTH 202-89	Triaxial Compressive Strength, Undrained w/o Pore Pressures Good quality core (Note R4) preferred, or blocks for coring	Core fragments min length 2.5X dia; Max 3-in. (75 mm) dia; one per test
ASTM D 4644	Slake Durability Core or block for obtaining fragments	Ten fragments 40-60 g each per test sample
Notes on Rock Tests	Note R1: Add charges for drilling core samples for testing Note R2: Photographs standard, decrease $10 per test if standard photographs are not desired Note R3: Add charges for preparation and compressive testing of cementitious grout mix Note R4: Good quality core requires sides to be straight to within 0.020-in. (0.50 mm)	

PART C

TESTS OF CEMENTITIOUS MATERIALS AND ADMIXTURES

Cost Estimates of Test and Analyses

Test	Description	Individual Test Cost Estimate, $
	Cement, Pozzolan, Slag, and Earth Materials	
ASTM C 91	Masonry Cement	
ASTM C 91	Water Retention	
ASTM C 109	Compressive Strength	
ASTM C 114	Alkali Content	
ASTM C 150	Portland cement (excluding heat of hydration alkalies, false set, sulfate (1) Chemistry (2) Physical	
ASTM C 185	Air Content	
ASTM C 186	Heat of hydration (1) 1 age (2) Each additional age	
ASTM C 188	Density	
ASTM C 204 ASTM C 430	Fineness (Portland Cement) (1) Air Permeability (2) 45-μm (No. 325) Sieve	
ASTM C 311	Reactivity with Cement Alkalies	
ASTM C 451	Early Stiffening (False Set)	
ASTM C 452	Sulfate Expansion	
ASTM C 595	Blended Hydraulic Cement (excluding heat of hydration and alkali expansion and Table 3) (1) Chemistry (2) Physical	
ASTM C 618	Fly ash and natural pozzolan (excluding reactivity) (1) Chemistry (2) Physical	
ASTM C 845	Expansive Hydraulic Cement	
ASTM C 989	Ground Granulated Blast-Furnace Slag	
ER 1110-1-2002	Specification Compliance, Complete chemical and physical analysis of special cements and pozzolan	
--	Phase Composition and Microstructure	

Cost Estimates (cont.)

Test	Description	Individual Test Cost Estimates, $
	Admixtures	
ASTM C 260	Air-Entraining Admixture a. Uniformity (check) test b. Abbreviated test c. Full evaluation d. Per drum release from pre-tested pool	
ASTM C 494	Water-Reducing Admixture a. Uniformity (check) test b. Abbreviated test c. Full evaluation d. Sampling and sealing per lot e. Transfer and resealing	
ASTM C 796	Cellular Concrete Foaming Agents	
ASTM C 937	Grout Fluidifier	

Quantities of Materials Required for Testing

Test	Description	Quantity Required
	Cementitious Material	
ASTM C 91	Masonry Cement	4-kg (9-lb)
ASTM C 114	Alkali Content	l-kg (2-lb)
ASTM C 186	Heat of Hydration (Two Ages)	3-kg (6-lb)
ASTM C 188	Specific Gravity	1-kg (2-lb)
ASTM C 207	Lime, Hydrated	4-kg (9-lb)
ASTM C 451	False Set	2-kg (4-lb)
CRD-C 200 (SS-C-1960/3/4/5)*	Detailed Analysis of Cement and Pozzolan	4-kg (9-lb)
--	Phase Composition	3-kg (7-lb)
	Admixtures	
ASTM C 260	Air-Entraining Admixture	
	a. Check test	1-L (1 qt)
	b. Abbreviated test	2-L (2-qt)
	c. Full test	2-L (2-qt)
	d. Per drum from pool (one sample/five drums)	1-L (1-qt)
ASTM C 494	Water-Reducing Admixture	
	a. Check test	1-L (1-qt)
	b. Abbreviated	2-L (2-qt)
	c. Full test	2-L (2-qt)
ASTM C 796	Cellular Concrete Foaming Agent	2-L (2-qt)
CRD-C 619	Grout Fluidifier	□-kg (1-lb) dry
--	Retarding Admixtures	2-L (2-qt)
--	Special Admixtures	1-L (1-qt) liquid □-kg (1-lb) dry

* Federal Specification

PART D

TESTS OF CONCRETE
AND SPECIAL SERVICES

Cost Estimates of Test and Analyses

Test	Description	Individual Test Cost Estimate, $
	Concrete	
ASTM C 39	Compressive Strength, 150- by 360-mm (6- by 12-in.) or smaller, loading capability to 4.5 x 10^6 N (1.0 x 10^6 lbf) (up to three tests)	
ASTM C 42	Drilled Cores and Sawed Beams a. Drilling or Sawing Specimens b. Compressive Strength (up to three tests) c. Flexural Strength (up to three tests)	
ASTM C 78	Flexural Strength, 150- by 300-mm (6- by 6-in.) or smaller (up to three tests)	
ASTM C 157	Length Change of Cement, Mortar, and Concrete	
ASTM C 215	Determination of Fundamental Frequencies, Modulus of Elasticity, and Poisson's Ratio(up to three tests)	
ASTM C 341	Length Change of Drilled or Sawed Specimens of Cement Paste, Mortar, and Concrete	
ASTM C 418	Abrasion Resistance, Sand Blasting Method	
ASTM C 457	Air Content of Hardened Concrete a. Microscopical (up to 37.5-mm (1-1/2-in.) NMSA concrete) b. To include Spacing Factor and Specific Surface (up to 37.5-mm (1-1/2-in.) NMSA concrete)	
ASTM C 469	Modulus of Elasticity (Static) a. Compressometer b. Strain Gages Modulus of Elasticity and Poisson's Ratio	
ASTM C 496	Splitting Tensile Strength, 150- by 30-mm (6- by 12-in.) or smaller cylindrical specimens (up to three tests)	
ASTM C 512	Uniaxial Creep Test	
ASTM C 597	Pulse Velocity	
ASTM C 642	Specific Gravity, Absorption, and Voids (Concrete)	
ASTM C 666	Resistance to Rapid Freezing and Thawing a. Casting: b. Testing:	

Cost Estimates (cont.)

Test	Description	Individual Test Cost Estimate, $
ASTM C 801	Triaxial Compressive Strength (three confining pressures)	
ASTM C 856	Petrographic Examination, per specimen	
ASTM C 944	Abrasion Resistance - Rotating Cutter Method	
ASTM C 1084	Cement Content of Hardened Concrete	
CRD-C 36	Thermal Diffusivity of Concrete (2 specimens, 1 age)	
CRD-C 37	Thermal Diffusivity of Mass Concrete (1 specimen, 1 age) a. Casting b. Testing	
CRD-C 38	Temperature Rise in Concrete (one specimen) a. Casting: b. Testing: Temperature Rise in Concrete, AHS, (Q Drum Test)(Transient) a. Casting b. Testing	
CRD-C 39	Coefficient of Thermal Expansion (concrete cast w/embedded Carlson Gages, 2 specimens, 1 age) Coefficient of Thermal Expansion (hardened concrete or stone W/electronic length comparator, 2 specimens)	
CRD-C 55	Concrete Mixer Uniformity Tests	
CRD-C 61	Resistance of Fresh Concrete to Washout	
CRD-C 63	Abrasion-Erosion Resistance of Concrete (Underwater Method) (mixture proportioning not included)	
CRD-C 71	Ultimate Tensile Strain Capacity of Concrete (One 3-beam series at one starting age) (mixture proportioning not included) a. Casting (includes strain meters) b. Testing (Beam 1: rapid-load at start date, Beam 2: slow-load at start date for ~90 days Beam 3: rapid-load at slow-load failure)	
CRD-C 99	Mixture Proportioning a. Determination of water content, sand content, and coarse aggregate proportions for either a specified water-cement ratio or a specified cement content. Includes tests on plastic concrete, molding tests specimens, and strength tests. Does not include handling and processing aggregates or determination of gradation and specific gravity of aggregates.	

Cost Estimates (cont.)

Test	Description	Individual Test Cost Estimate, $
	b. Determination of water-cement ratio required for a given strength by means of a W/C-Strength curve (3 points), in addition to other proportions. Includes tests on plastic concrete, molding test specimens, and strength tests. Does not include handling and processing aggregates or determination of gradation and specific gravity of aggregates: 19.0 -37.5-mm (3/4- to 1-1/2-in) NMSA 75-mm (3-in) NMSA	
CRD-C 124	Specific Heat of Aggregates, concrete and other materials (Two specimens at one age)	
	Specific Heat of Mass Concrete Four specimens tested at one age as follows: a. Two tests performed on mass concrete mortar fraction b. Two tests performed on coarse aggregate c. Specific heat for mass concrete computed from test results	
CRD-C 161	Mixture Proportioning for Roller-Compacted Concrete Pavements (Determination of water-cement ratio or optimum moisture content at a given cement necessary to meet a specified or required average compressive or flexural strength. Includes development of moisture-density relationships and molding and testing of strength specimens, but does not include handling and processing of aggregates or determination of aggregate and cementitious material properties)	
CRD-C 163	Water Permeability of Concrete (100-mm (4-in.) diameter specimen)	
CRD-C 164	Direct Tensile Strength of Concrete (75-, 100-, or 150-mm (3-, 4-, or 6-in.) diameter specimen)(up to three tests)	
EM 1110-2-2006	Mixture Proportioning for Roller-Compacted Mass Concrete Structures (Determination of water-cement ratio required for a given strength by means of a W/C-Strength curve (3 points) in addition to other proportions. Includes consistency tests using modified Vebe apparatus, molding test specimens, and strength tests. Does not include handling and processing of aggregates or determination of aggregate and cementitious material properties)	

Quantities of Materials Required for Testing

Test	Description	Quantity Required
	Concrete	
ASTM C 94	Abrasion Resistance by Rotating-Cutter	Material for 2.5 ft^3 of concrete
ASTM C 157	Length Change of Cement Paste, Mortar, each Concrete; cement, fine and coarse aggregate	9-kg (20-lb)
ASTM C 341	Length Change of Drilled or Sawed Specimens of Cement, Mortar, and Concrete cores or prisms	As specified
ASTM C 418	Abrasion Resistance by Sandblasting	Material for 2.5-ft^3 of concrete
ASTM C 512	Uniaxial Creep Test	See TABLE below

		Minimum Quantities of Materials, kg (lb)				
		Coarse Aggregate				
NMSA Concrete	Fine Aggregate	4.75 - 19.0-mm (No. 4 - 3/4-in.)	19.0 - 37.5-mm (3/4 - 1-1/2-in.)	37.5 - 75-mm (1-1/2 - 3-in.)	75 - 150-mm (3 - 6-in.)	Project Cement
19.0-mm (3/4-in.)	70 (150)	70 (150)	--	--	--	50 (100)
37.5-mm (1-1/2-in.)	70 (150)	70 (150)	70 (150)	--	--	50 (100)
75-mm (3-in.)	70 (150)	70 (150)	70 (150)	70 (150)	--	50 (100)
150-mm (6-in.)	110 (250)	80 (175)	90 (200)	100 (220)	130 (290)	50 (100)

ASTM C 642	Specific Gravity, Absorption, and Voids, each, several specimens	1-kg (2.2-lb)
ASTM C 666	Resistance to Freezing and Thawing	As specified
CRD-C 36	Thermal Diffusivity of Concrete, Adiabatic Heat Signature (Transient Test)	As specified
CRD-C 37	Thermal Diffusivity of Mass Concrete, Adiabatic Heat Signature (Transient Test)	As specified
CRD-C 38	Temperature Rise	See TABLE below

		Minimum Quantities of Materials, kg (lb)				
		Coarse Aggregates				
NMSA Concrete	Fine Aggregate	4.75 - 19.0-mm (No. 4 - ¾-in.)	19.0 - 37.5-mm (3/4 - 1-1/2-in.)	37.5 – 75-mm (1-1/2 – 3-in.)	75 – 150-mm (3 – 6-in.)	Project Cement
19.0-mm (3/4-in.)	900 (2000)	1500 (3300)	--	--	--	300 (660)
37.5-mm (1-1/2-in.)	900 (2000)	900 (2000)	1100 (2200)	--	--	300 (660)
75-mm (3-in.)	900 (2000)	900 (2000)	1100 (2200)	1200 (2650)	--	300 (660)
150-mm (6-in.)	900 (2000)	900 (2000)	1100 (2200)	1200 (2650)	1300 (2900)	300 (660)

CRD-C 39	Coefficient of Thermal Expansion (concrete)	As specified

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Concrete (Contd.)	
CRD-C 63	Abrasion-Erosion Resistance of Concrete (Underwater Method)	Material for 2.5-ft^3 of concrete
CRD-C 71	Ultimate Tensile Strain Capacity of Concrete	Material for 1-yd^3 of concrete
CRD-C 99	Mixture Proportioning	See TABLE below

Minimum Quantities of Aggregates, kg (lb)

NMSA Concrete	Fine Aggregate	Coarse Aggregates 4.75 - 19-mm (No. 4 - 3/4-in)	19 - 37.5-mm (3/4 - 1-1/2-in)	37.5 -75-mm (1-1/2 - 3-in)	75 - 150-mm (3 - 6-in)	Project Cement
19.0-mm (3/4-in)	1000 (2200)	1200 (2600)	--	--	--	600 (1300)
37.5-mm (1-1/2-in)	1000 (2200)	1000 (2200)	1000 (2200)	--	--	800 (1800)
75-mm (3-in)	2000 (4400)	2000 (4400)	2000 (4400)	2000 (4400)	--	800 (1800)
150-mm (6-in)	3000 (6600)	3000 (6600)	3000 (6600)	3000 (6600)	3000 (6600)	800 (1800)
Combined 19.0-mm & 37.5-mm	2000 (4400)	2000 (4400)	2000 (4400)	--	--	800 (1800)
Combined 19.0, 37.5, & 75-mm	4000 (8800)	4000 (8800)	2000 (4400)	2000 (4400)	--	1200 (2700)
Combined 19.0, 37.5, 75, & 150-mm	7000 (15000)	7000 (15000)	4000 (8800)	4000 (8800)	4000 (8800)	2000 (4400)

Notes:
1. If both-interior and exterior mixtures are desired for any size aggregate, quantities for that size should be doubled.
2. If a pozzolan is to be used-in the concrete, the quantity should be 40 % by mass of the cement.
3. 8-L (2-gal) of a proposed air-entraining admixture or chemical admixture will be required.

CRD-C 126	Thermal Coefficient of Expansion (mortar)	As specified

PART E

TESTS OF MISCELLANEOUS MATERIALS WATER, SOIL-CEMENT, BRICKS AND MASONRY UNITS, AND OTHER MATERIALS

Cost Estimates of Individual Tests and Analyses

Test	Description	Individual Test Cost Estimate, $
	Water	
ASTM C 932 (CRD-C 407)	Test for Iron Bacteria (four samples)	
ASTM D 993 (Preferred Method)	Test for Sulfate-Reducing Bacteria in Industrial Water and Water-Formed Deposits	
CRD-C 401	Water, for Curing a. Preliminary evaluation b. Complete evaluation	
CRD-C 402 CRD-C 403 CRD-C 404 CRD-C 405	Complete Chemical Analysis	
CRD-C 406	Water, for Mixing	
	Soil-Cement	
ASTM D 558 CRD-C 592	Moisture-Density Relations of Soil-Cement Mixtures	
ASTM D 559 CRD-C 593	Wetting and Drying of Compacted Soil-Cement Mixtures	
ASTM D 560 CRD-C 594	Freezing and Thawing of Compacted Soil-Cement Mixtures	
--	Compressive Strength	
--	Tensile Strength	
--	Soil Mineralogy	

Cost Estimates of Individual Tests and Analyses

Test	Description	Individual Test Cost Estimate, $
	Common Bricks	
ASTM C 55 (CRD-C 605)	Concrete Building Brick	
ASTM C 62	Building Brick (Solid Masonry Clay or Shale)	
ASTM C 73	Calcium Silicate (Sand-Lime) Face Brick	
ASTM C 216	Facing Brick a. Compressive strength b. Absorption and saturation coefficient c. Dimensions, cracks, warpage d. Efflorescence (facing brick) e. Freeze and thaw f. Modulus of rupture, flexure g. Initial rate of absorption	
	Paving Bricks and Blocks	
ASTM C 7	Paving Brick a. Examination b. Rattler test	
ASTM C 902	Pedestrian and Light Traffic Paving Brick a. Examination b. Compressive strength c. Absorption and saturation coefficient d. Warpage e. Efflorescence f. Freeze-thaw (50 cycles) g. Modulus of rupture, flexure h. Sulfate soundness (15 cycle)(freeze-thaw) I. Abrasion resistance	
--	Concrete Paving Blocks a. Examination b. Compressive strengths c. Absorption d. Freeze-thaw (50 cycles) e. Skid resistance	

Cost Estimates (cont.)

Test	Description	Individual Test Cost Estimate, $
	Refractory Bricks	
ASTM C 666 (CRD-C 20)	Resistance to Freezing and Thawing	
ASTM C 24	Pyrometric Cone Equivalent	
ASTM C 113	Reheat Change of Refractory Bricks	
ASTM C 133	Cold Crushing Strength and Modulus of Rupture of Refractory Brick and Shapes	
ASTM C 134	Size and Bulk Density of Refractory Bricks and Insulating Fire Brick	
ASTM C 154	Warpage of Refractory Brick and Tile, or Deviation from a Plane Surface	
--	Coefficient of Thermal Expansion	
	Tile	
ASTM C 34	Structural Clay Load-Bearing Wall Tile	
ASTM C 56	Structural Clay Nonload-Bearing Tile	
ASTM C 57	Structural Clay Floor Tile a. Compressive strength b. Absorption c. Dimensions, cracks, finish d. Freeze and thaw	
ASTM C 126	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units a. Compressive strength b. Dimension, cracks, finish c. Imperviousness d. Chemical resistance e. Opacity f. Autoclave crazing	

Cost Estimates (cont.)

Test	Description	Individual Test Cost Estimate, $
	Concrete Masonry	
ASTM C 90	Hollow Load-Bearing Concrete Masonry Units	
ASTM C 129	Nonload-Bearing Concrete Masonry Units	
ASTM C 145	Solid Load-Bearing Concrete Masonry Units a. Compressive strength b. Dimension, cracks, etc. c. Water absorption	
ASTM C 426	Drying Shrinkage of Concrete Block (three whole units or six half-face shells)	
ASTM C 427	Moisture Condition of Hardened Concrete by the Relative Humidity Method	
--	Other Test Methods and Test Procedures	
	Masonry Mortars	
ASTM C 67	Efflorescence of Masonry Mortars	
ASTM C 80	Water Retentivity of Masonry Mortars	
ASTM C 144	Aggregate for Masonry Mortar	
ASTM C 270	Unit Masonry Mortar Mixture Proportioning	
ASTM C 476	Masonry Grout	

Cost Estimates of Individual Tests and Analyses

Test	Description	Individual Test Cost Estimate, $
	Metals	
ASTM A 82	Cold-Drawn Steel Wire for Concrete Reinforcement (Tensile, Yield Point, Reduction in Area, Bend Test)	
ASTM A 184	Fabricated Steel Bar on Rod Mats for Concrete Reinforcement (Steel Certification, Connection Tests, Sizing) (two specimens)	
ASTM A 185	Welded Steel Wire Fabric for Concrete Reinforcement (Tension, Weld Shear, Bend, Sizing)	
ASTM A 322	Hot-Rolled Alloy Steel Bars	
ASTM A 370 ASTM E 8	Tension Testing of Metallic Materials (coupons, reinforcing bars, pipes) a. Yield, break, and ultimate stress b. Load-deformation curve c. Stress-strain curve d. All other tests	
ASTM A 416	Uncoated Seven-Wire Stress-Relieved Strand for Prestressed Concrete (Tension, Breaking Point, Yield Point, Elongation, Sizing)	
ASTM A 421	Uncoated, Stress-Relieved Wire for Prestressed Concrete (Yield Point, Tensile, Elongation, Cast, Button Anchorage)	
ASTM A 615	Deformed & Plain Billet-Steel Bars for Concrete Reinforcement (Tensile or Bend Tests) Specimen exceeding 20,000-lbf	
ASTM A 616	Rail-Steel Deformed and Plain Bars for Concrete Reinforcement (Tensile or Bend Tests) Specimen exceeding 20,000-lbf	
ASTM A 617	Axle Steel Deformed Bars for Concrete Reinforcement (Tensile or Bend Tests)	
--	Reinforcing Bar Weld (Tension or Bend Test)	

Cost Estimates (cont.)

Test	Description	Individual Test Cost Estimate, $
	Metals (Cont'd.)	
--	Splices in Reinforcing Steel, Thermit or Cadweld (Yield & Ultimate Point, Deformation) (Specimen exceeding 20,000-lbf)	
--	Noncorrosive Wire Reinforcing Fabric (Sizing, Tensile, Bending, Flexibility, Coating Quality & Thickness)	
--	Certification of Expansion Cement and Concrete Bar Threaded Restraining Rods (three specimens)	
--	All Other Types of Metals and Test Procedures	
	Floor Tile	
ASTM C 57	Clay Tile - Structural Clay Floor Tile	
SS-T-312*	Tile, Floor, Asphalt, Rubber, Vinyl, Vinyl Asbestos a. Asphalt b. Rubber c. Vinyl d. Vinyl-Asbestos	
MMM-A-110*	Adhesive - Asphalt, Cutback Type	
MMM-A-115*	Adhesive - Asphalt, Water-Emulsion Type	
--	All Other Tiles and Adhesives	
	Oils	
--	Lubricating Oils - All Applicable Federal, Military, and ASTM Specifications	
--	Insulating (Transformer) Oils - All Applicable Federal, Military, and ASTM Specifications	

Cost Estimates (cont.)

Test	Description	Individual Test Cost Estimate, $
	Roofing Materials	
	Asphalt	
ASTM D 312	a. For Constructing Built-Up Roof Coverings	
ASTM D 449	b. For Damp-Proofing and Water-Proofing	
SS-A-666*	c. Petroleum for Built-up Roofing, Water-Proofing, & Damp-Proofing	
SS-A-701*	d. Petroleum for Primer, Roofing, Water-Proofing	
	Roofing Felt	
SS-R-501*	a. Asphalt Prepared, Smooth Surface	
SS-R-630*	b. Asphalt Prepared, Mineral Surface	
HH-R-595*	c. Coal-Tar and Asphalt-Saturated Organics	
SS-S-298*	Shingles	
	a. Organic Fiber, Asphalt (Mineral Surfaced) (Thick Butt)	
	b. Organic Fiber, Asphalt (Mineral Surfaced) (Uniform Thickness)	
R-P-381*	Pitch & Coal Tar for Mineral Surfaced, Built-Up Roofing, Water-Proofing, Damp-Proofing	
--	All Other Roofing Materials	
	Other Materials	
CRD-C 261	Non-shrink Grout	
	a. Prepackaged type requiring water only	
	b. Volume-change controlling ingredient for addition to project material	
CRD-C 300	Curing Compound	
	a. Full Test	
	b. Per drum from pool	
CRD-C 316 (TT-T-291E)*	Solvents	
CRD-C 532 (ASTM D 2835)	Lubricant for Installation of Preformed Compression Seals in Concrete Pavements	
CRD-C 590 (MMM-G-650a)**	Epoxy Resin Binder or Grout	
CRD-C 591 (MMM-B-350B)**		

Cost Estimates (cont.)

Test	Description	Individual Test Cost Estimate, $
	Other Materials (Cont'd)	
ASTM C 881	Epoxy Resin a. Type I, II, VI, and VII b. Type III c. Type IV or V	
--	Mineralogy and microstructure of soils, clays, site rock, masonry units	

Quantities of Materials Required for Testing

Test	Description	Quantity Required
	Water	
ASTM C 932	Test for Iron Bacteria	1-L (1-qt)
ASTM D 993	Test for Sulfate-Reducing Bacteria	1-L (1-qt)
CRD-C 401	Water for Curing, Stain Test	3-L (3-qt)
CRD-C 402 CRD-C 403 CRD-C 404 CRD-C 405	Chemical Analysis	1-L (1-qt)
	Soil-Cement Design	
ASTM D 558	Moisture Density	30-kg (66-lb)
ASTM D 559	Wetting and Drying	30-kg (66-lb)
ASTM D 560	Freezing and Thawing	30-kg (66-lb)
--	Compressive and Tensile Splitting Strengths	As specified

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Common Brick	
ASTM C 55	Concrete Building Brick (per lot)	3
ASTM C 62	Building Brick (Solid Masonry, Clay, or Shale)(per 50,000 bricks)	10
ASTM C 73	Calcium Silicate Face Brick (per 50,000 bricks)	10
ASTM C 216	Facing Brick (per 50,000 bricks)	10
	Paving Bricks and Blocks	
ASTM C 7	Paving Brick (per 50,000 bricks)	10
ASTM C 902	Pedestrian and Light Traffic Paving Brick (per 50,000 bricks)	25
--	Concrete Paving Block (per 50,000 blocks)	12
	Refractory Bricks	
ASTM C 24	Pyrometric Cone Equivalent	5
ASTM C 113	Reheat Change of Refractory Bricks	3
ASTM C 133	Cold Crushing Strength and Modulus of Rupture of Refractory Bricks and Shapes (min.)	5
ASTM C 134	Size and Bulk Density of Refractory Bricks and Insulating Fire Brick	10
ASTM C 154	Warpage of Refractory Brick, or Deviation from a Plane Surface	20
ASTM C 666	Resistance to Freezing and Thawing	5
--	Coefficient of Thermal Expansion	5
--	For All Specification Tests	25

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Tile	
ASTM C 34	Structural Clay Load-Bearing Wall Tile (each kiln or lot)	5
ASTM C 56	Structural Clay Nonload-Bearing Tile (each kiln or lot)	5
ASTM C 57	Structural Clay Floor Tile (each kiln or lot)	5
ASTM C 126	Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units	1,000
	(each additional 30,000 units)	10
	Concrete Masonry	
ASTM C 90	Hollow Load-Bearing Units (10,000 units)	10
	(10,000 units and greater)	20
ASTM C 129	Nonload-Bearing Units (10,000 units)	10
	(10,000 units and greater)	20
ASTM C 145	Solid Load-Bearing Units (10,000 units)	10
	(10,000 units and greater)	20
ASTM C 426	Dry Shrinkage of Concrete Block (half-face shells)	3
ASTM C 427	Moisture Condition by the Relative Humidity Method	As specified
	Masonry Mortars	
ASTM C 67	Efflorescence adapted for Mortars	As Specified
ASTM C 80	Water Retentivity	As Specified
ASTM C 144	Aggregate for Masonry Mortar	15-kg (33-lb)
ASTM C 270	Unit Masonry Mortar Mixture Proportioning	As Specified
ASTM C 476	Reinforced Masonry Mortar Mixture Proportioning	As Specified

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Metals	
ASTM A 82	Cold-Drawn Steel Wire for Concrete Reinforcement (9071-kg (10-ton) lots)	2
ASTM A 184	Fabricated Steel Bar or Rod Mats for Concrete Reinforcement (each 1,000 mats)	2
ASTM A 185	Welded Steel Wire Fabric for Concrete Reinforcement	0.1-m^2 (1.1-ft^2)
ASTM A 322	Hot Rolled Alloy Steel Balls	As specified
ASTM A 370	Steel Products (Mechanical Tests)	As specified
ASTM A 416	Uncoated Seven-Wire Stress-Relieved Strand for Prestressed Concrete (18,142-kg (20-ton) lots)	2
ASTM A 421	Uncoated Stress-Relieved Wire for Prestressed Concrete (each 10 coils per lot)	1
ASTM A 615	Deformed and Plain Billet Steel Bars for Concrete Reinforcement (each heat)	2
ASTM A 616	Rail Steel Deformed and Plain Bars for Concrete Reinforcement (9,071-kg (10-ton) lots)	2
ASTM A 617	Axle Steel Deformed Bars for Concrete Reinforcement (9,071-kg (10-ton) lots)	2
--	Splices and Welds	As specified
--	Noncorrosive Wire Reinforcing Fabric	As specified
--	Certification of Threaded Restraining Rods (per lot)	3
--	All Other Types of Metals and Test Procedures	As specified

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Floor Tile	
ASTM C 57	Clay Tile (each kiln or each 90,718-kg (100-ton))	5
SS-T-312*	Asphalt, Rubber, Vinyl, & Vinyl Asbestos Tile (per 10,000 of each type, color, or size)	20
MMA-A-110*	Adhesive, Asphalt, Cutback Type	4-L (4-qt)
MMM-A-115*	Adhesive, Asphalt, Water Emulsion Type	4-L (4-qt)
--	All Other Tiles and Adhesives	As specified
	Oils	
--	Lubricating Oil	As specified
--	Insulating (Transformer) Oil	As specified
	Roofing Material	
ASTM C 312 (SS-A-701)* ASTM D 449 (SS A 666)*	Asphalt	1-L (1-qt)
SS-R-501* SS-R-630* HH-R-595*	Roofing Felts	As specified
SS-S-298* SS-S-300*	Shingles	As specified
R-P-381*	Pitch and Coal Tar	1-L (1-qt)

* Federal Specification Standard

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Other Materials	
ASTM C 881	Epoxy-Resin Base Bonding Systems (each component)	2-L (2-qt)
ASTM D 2835	Lubricant for Preformed Pavement Seals (each lot)	1-L (1-qt)
CRD-C 300	Curing Compound	As specified
CRD-C 316 (TT-T-291E)*	Solvent	2-L (2-qt)
CRD-C 590 MMM-G-650a* CRD-C 591 MMM-B-350B*	Epoxy Resin Binder or Grout (each component)	2-L (2-qt)
CRD-C 621	Non-shrink Grout (minimum of 1 package)	0.03-m^3 (1-ft^3)
--	Mineralogy and Microstructure of Soils, Clays, Site Rocks, and Masonry Units	As specified

* Federal Specification Standard

PART F

TESTS OF WATERSTOPS AND GATE SEALS, JOINT SEAL AND FILLERS, JOINT SEALERS, CAULKING AND SEALING MATERIALS,

Cost Estimates of Tests and Analyses

Test	Description	Individual Test Cost Estimate, $
	Waterstops and Gate Seals	
CRD-C 513	Rubber Waterstops and Gate Seals	
	a. Full evaluation of single lot (initial 200 lineal ft)	1,750
	b. Tensile strength and elongation test (each additional 200 lineal feet of the same lot)	195
	c. Job-Made Splices	295
CRD-C 572	Polyvinyl Chloride Waterstops	
	a. Full evaluation of single lot (initial 200 lineal ft)	1,560
	b. Tensile strength and elongation test (each additional 200 lineal feet of the same lot)	195
	c. Job-Made Splices	295
--	Full-Size Evaluation of Waterstops and Job Splices	Cost
	Preformed Joint Seals and Fillers	
ASTM D 994	Preformed Expansion Joint Filler for Concrete Bituminous Type	490
ASTM D 1751	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (non-extruding and resilient bituminous types)	490
ASTM D 1752	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction	490
ASTM D 2628	Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements	1,560
ASTM D 2635	Adhesive/Lubricant for Installation of Preformed Joint Seals	490

Cost Estimates (cont.)

Test	Description	Individual Test Cost Estimate, $
	Joint Sealers	
CRD-C 506* (TT- S-00227E)**	Elastomeric Type, Multi-component (for caulking, sealing, and glazing in buildings and structures)	Cost
CRD-C 526* (SS- S-200E)**	Sealing Compounds, Two-Component, Elastomeric Polymer Type, Jet Fuel Resistant, Cold Applied	2,925
CRD-C 529* (SS-S-1614A)**	Sealing Compound, Jet Fuel Resistant, Hot Applied, One Compound (portland cement and tar concrete)	2,340
CRD-C 530* (SS-S-1401C)**	Sealing Compound, Hot Applied, For Concrete and Asphalt Pavements	2,340
	Caulking and Sealing Materials	
CRD-C 506* (TT-S-00227E)**	Elastomeric Type, Multi-component	Cost
CRD-C 507 (TT-C-00598C)**	Oil- and Resin-Base Type (For Building Construction)	490
CRD-C 541 (TT-S-230a)**	Elastomeric Type, Single Component	780
CRD-C 542 (TT-S-001543A)**	Silicone Rubber Base	780
CRD-C 543 (TT-S-001657)**	Single Component, Butyl Rubber Base, Solvent-Release Type	685
TT-P-00791B**	Linseed Oil Type (for wood-sash glazing)	Cost
--	Other Types	Cost

* POC, Dr. Kent Newman, (601) 634-3858
** Federal Specification Standard

Quantities of Materials Required for Testing

Test	Description	Quantity Required
	Waterstops and Gate Seals	
CRD-C 513	Rubber Waterstop and Gate Seals,	
	a. Full evaluation, initial 60-m (200-lineal ft)	1.2-m (4-ft)
	b. Tensile strength and elongation, each additional 60-m (200-ft)	1.2-m (4-ft)
	c. Job-made splices	1 sample
CRD-C 572	Polyvinyl Chloride Waterstops	
	a. Full evaluation, initial 60-m (200-lineal ft)	1.2-m (4-ft)
	b. Tensile strength and elongation, each additional 60-m (200-ft)	1.2-m (4-ft)
	c. Job-made splices	1 sample
	Joint Fillers	
ASTM C 994	Preformed Expansion Joint Filler for Concrete, Bituminous Type (per 93-m^2 (1,000-ft^2))	387-cm^2 (60-in^2)
ASTM D 1751	Preformed Expansion Joint Filler (Non-extruding and Resilient Bituminous Types)(per 93-m^2 (1,000-ft^2))	0.2-m^2 (2-ft^2)
ASTM D 1752	Preformed Sponge Rubber & Cork Expansion Joint Fillers (per 93-m^2 (,1000-ft^2))	0.2-m^2 (2-ft^2)
ASTM D 2628	Preformed Polychloroprene Elastomeric Joint Seals If less than 25-mm (1-in.) width	2.8-m (9-lin ft) 3.7-m (12-lin ft)
ASTM D 2835	Adhesive - Lubricant for Installation of Preformed Joint Seals in Concrete Pavements	1-L (1-qt)
CRD-C 507 (TT-C-00598C)*	All Caulking and Sealing Compounds, for large bulk containers, composite sample from top, middle, & bottom	1-L (1-qt)
CRD-C 506 (TT-S-00227E)* CRD-C 541 (TT-S-230a)* CRD-C 542 (TT-S-001543A)* CRD-C 543 (TT-S-001657)*	For small lots of material, Federal Test Method Standard No. 141	Method 1021
TT-P-0791B*	Putty, Linseed-Oil Type, for large bulk containers, composite sample from top, middle & bottom	1-L (1-qt)
	For small lots of material, Federal Test Method Standard No. 141	Method 1021

* Federal Specification

Quantities of Materials Required for Testing (cont.)

Test	Description	Quantity Required
	Joint Sealers	
CRD-C 506 (TT-S-00227E)*	Elastomeric Type, Multi-component (Buildings & Other Structures) (each component and lot) (include sufficient primer)	8-L (8-qt)
CRD-C 526 (SS-S-200E)*	Elastomeric Polymer Type, Two-Component, Jet Fuel Resistant, Cold Applied (each component and lot) (include sufficient primer)	8-L (8-qt)
CRD-C 530 (SS-S-1401C)*	Hot Applied, for Concrete and Asphalt Pavements (each lot)	8-L (8-qt)
SS-S-1614A*	Sealing Compound, Jet Fuel Resistant, Hot Applied, One Component, for Portland Cement and Tar Concrete Pavements (each lot)	8-L (8-qt)

Part G

TESTS OF ASPHALT, ASPHALT MATERIALS, AND GEOTEXTILES

Costs of Individual Tests and Analyses

Test	Description	Cost, $
	Asphalt Binder Testing	
ASTM D 3381	Asphalt Cement (AC)	1000
ASTM D 2171	Viscosity 140F (60C)	200
ASTM D 2170	Viscosity 275F (60C)	200
ASTM D 5	Penetration 77F (25C)	100
ASTM D 92	Flash Point , Cleveland Open Cup	200
ASTM D 113	Ductility 77F (25 C)	150
ASTM D 70	Specific Gravity of AC	
ASTM D 2042	Solubility in Trichloroethylene	
ASTM D 36/D 2398	Softening Point	
ASTM D 1754	Thin Film Oven	
ASTM D 2872	Rolling Thin Film Oven Test	
AASHTO PP6-93	SHRP* Performance Grading (PG): per sample more than 5 samples	1000 800
AASHTO PP6-93	Verification of SHRP* PG: per sample more than 5 samples	800 600
AASHTO PP5-93	Evaluation of Modified Asphalt forensic analysis of asphalt binders individual SHRP* tests	200 Cost Cost
	Aggregate Tests	
ASTM C 136	Sieve analysis washed per sample	200
ASTM C 127/C 128	Specific Gravity: apparent or bulk per sample	200
ASTM D 4791	Flat/elongated particles per sample	100
ASTM C 131	Los Angeles (LA) Abrasion per sample	300

* Strategic Highway Research Program

Costs (cont.)

Test	Description	Cost, $
	Mix Designs	
Mil-Std 620A TM 5-822-8 CEGS-02551, 02556, 02557	Hot Mix Design	4000
Mil-Std 620A TM 5-822-8 CEGS-02552	Cold Mix Design	5000
ETL 1110-1-177	Resin Modified Pavement Open-Graded Resin Modified Pavement Grout	4000 3000
	Compaction Methods	
Mil-Std 620A TM 5-822-8	Marshall 75 Blow(200 PSI) 4"Dia.(10 lb/18"drop) Marshall 50 Blow(100 PSI) 4"Dia.(10 lb/18"drop) Mechanical with Slanted Foot 4"Dia.(10 lb/18"drop) Mechanical 6"Dia.(22 lb/18"drop)	 Cost Cost Cost Cost
ASTM D 3387	Corp Gyratory 4",6", and 8" diameter samples	 Cost
AASHTO PP 28-95	Superpave Gyratory 4" and 6" diameter samples	 Cost
	Asphalt Mixture Tests	
	Recompaction Study	Cost
	Field Sample Evaluation	Cost
ASTM D 2172	Extraction of AC	200
ASTM D 1856	Recovery of AC (Abson Method)	200
ASTM D 2041	Maximum theoretical specific gravity (Rice)	200
ASTM D 1559	Marshall Stability	175
ASTM D 4123	Indirect Tensile	175

Costs (cont.)

Test	Description	Cost, $
	Geotextile Tests	
ASTM D 4595	Tensile Test (per test)	100
ASTM D 461/D 3786	Breaking Strength (per test)	300
D 3656/D 3787/D 3940	Bursting Puncture (Per Test)	300
ASTM D 4685	Abrasion	550
	Joint Sealant Tests	
Federal Specification 200 D and E	Hand and Machine Mix 2 comp.	3,500
Federal Specification 1614	Hot Pour	3,300
Federal Specification 1401	Hot Pour	3,300
Federal Specification 227	Silicones	4,200
	Forensic Analysis of Joint Sealants	Cost

Quantities of Materials Required for Testing

Test	Description	Quantity Required
	Asphalt	
ASTM D 3381	Asphalt Binder Testing (per sample)	1 gal.
AASHTO PP6-93	SHRP Performance Grading	1 gal.
AASHTO PP5-93	Evaluation of Modified Asphalts	1 gal.
	Aggregate Stockpile Testing	45.5 kg (100 lb)
MIL-STD 620A/TM 5-822-8	Mix Design Asphalt	5 gal.
ETL 1110-1-177	Resin Modified Pavement PL-7	5 gal.
	Asphalt Mixture Tests	CALL
	Geotextile Tests	CALL
Federal Specification 200 D&E	Joint Sealant Testing (2 Component)	5 gal. (Ea. Comp.)
Federal Specification 1614	Joint Sealant Testing (Hot Pour)	5 gal.
Federal Specification 1401	Joint Sealant Testing (Hot Pour)	5 gal.